

# **2018 15th European Radar Conference (EuRAD 2018)**

**Madrid, Spain  
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## EuRAD02 : Radar Applications

Chair: Mateo Burgos-García, Universidad Politécnica de Madrid, Spain

Co-Chair: Carlos Castillo, Indra Sistemas, Spain

Time 10:50-12:30, 26 Sept 2018, N108

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- N/A      **Advances in Space Radar and Telecommunications Microwave Equipment** (Industrial Session Keynote)  
*Andrea Suriani, Thales Alenia Space, Italy*
- 2      **UAV-Mounted GPR for NDT Applications**  
*Maria Garcia-Fernandez<sup>1</sup>, Yuri Alvarez-Lopez<sup>1</sup>, Borja Gonzalez-Valdes<sup>2</sup>, Ana Arboleya-Arboleya<sup>3</sup>, Yolanda Rodriguez-Vaqueiro<sup>2</sup>, Fernando Las-Heras<sup>1</sup>, Antonio Pino<sup>2</sup>*  
*<sup>1</sup>Universidad de Oviedo, Spain; <sup>2</sup>Universidade de Vigo, Spain; <sup>3</sup>Universidad Rey Juan Carlos, Spain*
- 6      **LTE-R Based Passive Multistatic Radar for High-Speed Railway Network Surveillance**  
*Rodrigo Blázquez-García, Jorge Casamayón-Antón, Mateo Burgos-García, Universidad Politécnica de Madrid, Spain*
- 10      **Three-Dimensional Advanced Tomographic Procedure for the Imaging of Metallic and Dielectric Targets Through GPR Data**  
*Federica Murgia<sup>1</sup>, Davide Comite<sup>1</sup>, Ilaria Catapano<sup>2</sup>, Francesco Soldovieri<sup>2</sup>, Alessandro Galli<sup>1</sup>*  
*<sup>1</sup>Università di Roma "La Sapienza", Italy; <sup>2</sup>CNR-IREA, Italy*
- 14      **Multistatic Holographic Imaging for Breast Cancer Detection**  
*Iqra Asghar<sup>1</sup>, Asim Ali Khan<sup>1</sup>, Anthony Keith Brown<sup>2</sup>*  
*<sup>1</sup>COMSATS University Islamabad, Pakistan; <sup>2</sup>University of Manchester, UK*

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## EuRAD03 : Automotive Radar 1

Chair: Marina Gashinova, University of Birmingham, UK

Co-Chair: Carlos Castillo, Indra Sistemas, Spain

Time 08:30-10:10, 27 Sept 2018, N101 + N102

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- 18      **Autonomous Driving Features Based on 79GHz Polarimetric Radar Data**  
*Stefan Trummer<sup>1</sup>, Gerhard F. Hamberger<sup>2</sup>, Richard Koerber<sup>1</sup>, Uwe Siart<sup>2</sup>, Thomas F. Eibert<sup>2</sup>*  
*<sup>1</sup>ASTYX, Germany; <sup>2</sup>Technische Universität München, Germany*
- 22      **Expanding the Unambiguous Velocity Limitation of the Stepped-Carrier OFDM Radar Scheme**  
*Benedikt Schweizer<sup>1</sup>, Daniel Schindler<sup>2</sup>, Christina Knill<sup>1</sup>, Jürgen Hasch<sup>2</sup>, Christian Waldschmidt<sup>1</sup>*  
*<sup>1</sup>Universität Ulm, Germany; <sup>2</sup>Robert Bosch, Germany*
- 26      **Self-Adaptive Short-Range Leakage Canceler for Automotive FMCW Radar Transceivers**  
*Alexander Melzer<sup>1</sup>, Alexander Onic<sup>2</sup>, Mario Huemer<sup>3</sup>*  
*<sup>1</sup>Infineon Technologies, Austria; <sup>2</sup>DICE, Austria; <sup>3</sup>Johannes Kepler Universität Linz, Austria*
- 30      **Polarimetric SAR for Automotive Applications**  
*Hasan Iqbal, Christina Knill, Muhammad Zeeshan Khan, Tobias Chaloun, Christian Waldschmidt, Universität Ulm, Germany*
- 34      **Impact of an Automotive Chirp-Sequence Interferer on a Wideband OFDM Radar**  
*Christina Knill, Benedikt Schweizer, Philipp Hügler, Christian Waldschmidt, Universität Ulm, Germany*

## EuRAD04: Special Session: Radar Projects at the European Defense Agency

Chair: Mateo Burgos-García, Universidad Politécnica de Madrid, Spain

Co-Chair: Ignacio Montiel Sanchez, European Defense Agency, Belgium

Time 08:30-10:10, 27 Sept 2018, N115 + N116

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- N/A      **Deep Learning for Automatic Target Recognition with Radar**  
*Matijs Heiligers, Albert G. Huizing, Jacco J.M. de Wit, TNO, The Netherlands*
- N/A      **Multichannel Passive ISAR Imaging for Military Applications (MAPIS)**  
*F. Berizzi<sup>1</sup>, M. Conti<sup>1</sup>, A. Capria<sup>1</sup>, E. Giusti<sup>1</sup>, A.L. Saverino<sup>1</sup>, K. Kulpa<sup>2</sup>, I. Pisciotto<sup>3</sup>, S. Briskin<sup>3</sup>, A. Di Lallo<sup>4</sup>, L. Kovacs<sup>5</sup>, R. Seller<sup>6</sup>, Nicola Battisti<sup>7</sup>, M.P.J. Amores<sup>8</sup>*  
<sup>1</sup>CNIT, Italy; <sup>2</sup>Warsaw University of Technology, Poland; <sup>3</sup>Fraunhofer FHR, Germany; <sup>4</sup>Leonardo, Italy; <sup>5</sup>MTA, Hungary; <sup>6</sup>BME, Hungary; <sup>7</sup>MBDA, Italy; <sup>8</sup>Universidad de Alcalá, Spain
- N/A      **Managing and Promoting Innovation in Defence: EDA's R&T Activities Related to RF Sensor Technologies**  
*Roland Krebs, European Defence Agency, Belgium*
- N/A      **Architectures for Multifunction RF & Optronics Sensors Onboard RPAS Platforms**  
*Adrián Jimenez<sup>1</sup>, Miguel Alfageme<sup>2</sup>, David Llamazares<sup>1</sup>, Valentín Polo<sup>2</sup>, Elisabeth Pérez<sup>1</sup>, Santiago Simón<sup>2</sup>*  
<sup>1</sup>everis Aeroespacial y Defensa, Spain; <sup>2</sup>DAS Photonics, Spain
- N/A      **Signal Processing for Enhanced Radar Imaging**  
*Stefan Brüggewirth<sup>1</sup>, Simon Wagner<sup>1</sup>, Tanja Bieker<sup>1</sup>, Nicola Battisti<sup>2</sup>, Vincenzo Rispoli<sup>2</sup>, Mario Greco<sup>3</sup>, Marco Messina<sup>3</sup>, Gianpaolo Pinelli<sup>3</sup>, Davide Cataldo<sup>4</sup>, Marco Martorella<sup>5</sup>*  
<sup>1</sup>Fraunhofer FHR, Germany; <sup>2</sup>MBDA, Italy; <sup>3</sup>IDS Ingegneria Dei Sistemi, Italy; <sup>4</sup>CNIT, Italy; <sup>5</sup>Università di Pisa, Italy

## EuRAD05: Automotive Radar 2

Chair: Andreas Stelzer, Johannes Kepler Universität Linz, Austria

Co-Chair: Gonzalo de Miguel Vela, Universidad Politécnica de Madrid, Spain

Time 10:50-12:30, 27 Sept 2018, N101 + N102

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- N/A      **Automotive Radars & Autonomous Driving Perspective (Industrial Session Keynote)**  
*Juan Sanmartín Jara, Jaguar Land Rover, UK*
- 59      **Target Localization Using MIMO-Monopulse: Application on 79GHz FMCW Automotive Radar**  
*Ruoyu Feng, Faruk Uysal, Alexandar Yarovoy, Technische Universiteit Delft, The Netherlands*
- 63      **A New Antenna Array and Signal Processing Concept for an Automotive 4D Radar**  
*Martin Stolz<sup>1</sup>, Maximilian Wolf<sup>1</sup>, Frank Meinel<sup>1</sup>, Martin Kunert<sup>1</sup>, Wolfgang Menzel<sup>2</sup>*  
<sup>1</sup>Robert Bosch, Germany; <sup>2</sup>Universität Ulm, Germany
- 67      **Error Analysis of Target Angle and Angular Velocity in a PLL-Based FMCW Radar Measurement**  
*Frank Herzel, Dietmar Kissinger, IHP, Germany*
- 71      **Analytical Investigation of Non-Coherent Mutual FMCW Radar Interference**  
*Mate Toth<sup>1</sup>, Paul Meissner<sup>2</sup>, Alexander Melzer<sup>2</sup>, Klaus Witrisal<sup>1</sup>*  
<sup>1</sup>Technische Universität Graz, Austria; <sup>2</sup>Infineon Technologies, Austria

## EuRAD06 : Radar Target Classification and Tracking

Chair: Krzysztof Kulpa, Warsaw University of Technology, Poland

Co-Chair: Laura Anitori, TNO, The Netherlands

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- 75      **Image-Based Pedestrian Classification for 79GHz Automotive Radar**  
*Robert Prophet<sup>1</sup>, Marcel Hoffmann<sup>1</sup>, Alicja Ossowska<sup>2</sup>, Waqas Malik<sup>2</sup>, Christian Sturm<sup>2</sup>, Martin Vossiek<sup>1</sup>*  
*<sup>1</sup>FAU Erlangen-Nürnberg, Germany; <sup>2</sup>Valeo Schalter und Sensoren, Germany*
- 79      **A Chirplet Transform-Based Algorithm for Detecting Accelerated Radar Targets**  
*Volodymyr G. Galushko, Dmytro M. Vavriv, NASU, Ukraine*
- 83      **Detection of People Trapped Under the Ruins Using Dual-Frequency IR-UWB Radar**  
*Zhao Li, Qiang An, Fugui Qi, Fulai Liang, Hao Lv, Yang Zhang, Xiao Yu, Jianqi Wang,*  
*Fourth Military Medical University, China*
- 87      **Robust Correlation Based True-Speed-Over-Ground Measurement System Employing a FMCW Radar**  
*Torsten Reissland<sup>1</sup>, Bjoern Lenhart<sup>1</sup>, Johann Lichtblau<sup>1</sup>, Michael Sporer<sup>1</sup>, Robert Weigel<sup>1</sup>, Alexander Koelpin<sup>2</sup>*  
*<sup>1</sup>FAU Erlangen-Nürnberg, Germany; <sup>2</sup>Brandenburgische Technische Universität, Germany*
- 91      **Modifications of the OPTICS Clustering Algorithm for Short-Range Radar Tracking Applications**  
*Thomas Wagner, Reinhard Feger, Andreas Stelzer, Johannes Kepler Universität Linz, Austria*

## EuRAD07 : EM Field Scattering and Target RCS

Chair: Alexander Yarovoy, Technische Universiteit Delft, The Netherlands

Co-Chair: Alessandro Galli, Università di Roma "La Sapienza", Italy

Time 10:50-12:30, 27 Sept 2018, N115 + N116

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- 95      **Modeling the Forward-Scatter Cross Section of 3-Dimensional Objects by Means of the Shadow Contour Theorem: An Assessment**  
*Davide Comite, Marta Tecla Falconi, Alessandro Galli, Frank Silvio Marzano, Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy*
- 99      **A Plane-Wave Synthesis Approach for 3D Monostatic RCS Prediction from Near-Field Measurements**  
*Ole Neitz, Thomas F. Eibert, Technische Universität München, Germany*
- 103      **Simulation of Near Field RCS to Reproduce Measurement Condition**  
*Jose M. Tamayo-Palau, Pascal de-Resseguier, NEXIO, France*
- 107      **Advanced Spectral Model of Doppler-Polarimetric Meteorological Radar Signal**  
*Anna Rudiakova, Yuliya Averyanova, Felix Yanovsky, National Aviation University, Ukraine*
- 111      **Electrodynamic Study of Forward- and Backward-Scattering from Spherical Targets**  
*B. Salski, P. Kopyt, K. Kulpa, P. Samczynski, Warsaw University of Technology, Poland*

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## EuRAD08: Industrial Applications

Chair: Jesús Grajal, Universidad Politécnica de Madrid, Spain

Co-Chair: Reinhard Feger, Johannes Kepler Universität Linz, Austria

Time 13:50–15:30, 27 Sept 2018, N101 + N102

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- 115      **3D Millimeter Wave Screening of Wind Turbine Blade Segments**  
*R. Herschel<sup>1</sup>, S. Pawliczek<sup>2</sup>*  
<sup>1</sup>Fraunhofer FHR, Germany; <sup>2</sup>Ruhr-Universität Bochum, Germany
- 118      **Real-Time Wireless Vibration Monitoring Using SAW RFID Tags Coupled with Sensors**  
*Pau Caldero<sup>1</sup>, Dominik Zoeke<sup>2</sup>*  
<sup>1</sup>FAU Erlangen-Nürnberg, Germany; <sup>2</sup>Siemens, Germany
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*Sabine Gütgemann<sup>1</sup>, Christian Krebs<sup>1</sup>, Andries Küter<sup>1</sup>, Dirk Nüßler<sup>1</sup>, Bettina Fischer<sup>2</sup>, Horst Krauthäuser<sup>2</sup>*  
<sup>1</sup>Fraunhofer FHR, Germany; <sup>2</sup>IMS Messsysteme, Germany

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## EuRAD09: MIMO Radars

Chair: Pierfrancesco Lombardo, Università di Roma “La Sapienza”, Italy

Co-Chair: Stéphane Meric, IETR (UMR 6164), France

Time 13:50–15:30, 27 Sept 2018, N105

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- 126      **Joint Super-Resolution and Array Interpolation for MIMO Radar Virtual Arrays**  
*Maurice Hott<sup>1</sup>, Jan Mietzner<sup>2</sup>, Steffen Lutz<sup>3</sup>, Michael Bockmair<sup>3</sup>, Peter A. Hoeher<sup>1</sup>*  
<sup>1</sup>Christian-Albrechts-Universität zu Kiel, Germany; <sup>2</sup>Technische Universität Hamburg-Harburg, Germany; <sup>3</sup>HENSOLDT Sensors, Germany
- 130      **2D Maximum Likelihood Angle Estimation for MIMO Radar with Unequally Spaced L-Shaped Arrays**  
*Takaaki Kishigami, Kenta Iwasa, Hidekuni Yomo, Akihiko Matsuoka, Junji Sato,*  
*Panasonic, Japan*
- 134      **Frequency Domain System Identification for High Resolution IRCI-Free Collocated MIMO Radar**  
*M. AlShaya<sup>1</sup>, Mehrdad Yaghoobi<sup>2</sup>, B. Mulgrew<sup>2</sup>*  
<sup>1</sup>KACST, Saudi Arabia; <sup>2</sup>University of Edinburgh, UK
- 138      **Orthogonal Waveform Designs for Pulse-Based and Continuous-Wave MIMO Radars**  
*Gowthami Pypalli<sup>1</sup>, Jan Mietzner<sup>2</sup>, Volker Winkler<sup>3</sup>, Peter A. Hoeher<sup>1</sup>*  
<sup>1</sup>Christian-Albrechts-Universität zu Kiel, Germany; <sup>2</sup>Technische Universität Hamburg-Harburg, Germany; <sup>3</sup>HENSOLDT Sensors, Germany
- 142      **Effectiveness of Deghosting Process for Multi-Target Localization in Multistatic Passive Radar**  
*M. Abdul Hadi, Raza Umar, Mobein Shoaib, Muhammad Bilal, Khalid Jamil, King Saud University, Saudi Arabia*

## EuRAD10: Synthetic Aperture Radar

Chair: Laurent Ferro-Famil, University of Rennes 1, France

Co-Chair: Yuliya Averyanova, National Aviation University, Ukraine

Time 13:50-15:30, 27 Sept 2018, N107

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*Aron Sommer, Jörn Ostermann, Leibniz Universität Hannover, Germany*
- 150      **Comparison Between Rectangular and Hexagonal Synthetic Apertures for Radar Imaging**  
*Jonas Wagner, Jan Barowski, Christoph Dahl, Ilona Rolfes, Ruhr-Universität Bochum, Germany*
- 154      **Subjective Evaluation of Compressed SAR Images Using JPEG and HEVC Intra Coding: Sometimes, Compression Improves Usability**  
*Ulrike Pestel-Schiller, Jörn Ostermann, Leibniz Universität Hannover, Germany*
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*S. Lukin<sup>1</sup>, V. Pascazio<sup>1</sup>, K. Lukin<sup>2</sup>, D. Tatyanko<sup>2</sup>, O. Zemlyaniy<sup>2</sup>*  
*<sup>1</sup>Università di Napoli "Parthenope", Italy; <sup>2</sup>NASU, Ukraine*

## EuRAD11: Multi-Static and Netted Radar

Chair: Willem A. Hol, Thales, The Netherlands

Co-Chair: Gaspare Galati, Università di Roma "Tor Vergata", Italy

Time 13:50-15:30, 27 Sept 2018, N115 + N116

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*Benjamin Gabard, Laurent Casadebaig, Thierry Deloues, Alexandre Amiez, Pierre Escalas, Dominique Poullin, Olivier Rabaste, Hervé Jeuland, ONERA, France*
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*Jacco J.M. de Wit, Wim L. van Rossum, TNO, The Netherlands*
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*Leonardo Lembo<sup>1</sup>, Paolo Ghelfi<sup>2</sup>, Antonella Bogoni<sup>1</sup>*  
*<sup>1</sup>Scuola Superiore Sant'Anna, Italy; <sup>2</sup>CNIT, Italy*
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*David Escot-Bocanegra<sup>1</sup>, David Poyatos-Martínez<sup>1</sup>, Borja Plaza-Gallardo<sup>2</sup>*  
*<sup>1</sup>INTA, Spain; <sup>2</sup>ISDEFE, Spain*
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*Peter W. Moo<sup>1</sup>, David J. DiFilippo<sup>2</sup>*  
*<sup>1</sup>DRDC, Canada; <sup>2</sup>Dannaven, Canada*

## EuRAD12: Radar Micro Doppler Analysis

Chair: Felix Yanovsky, National Aviation University, Ukraine

Co-Chair: Jacco J. M. de Wit, TNO, The Netherlands

Time 08:30-10:10, 28 Sept 2018, N101 + N102

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*Svante Björklund, FOI, Sweden*
- 186      **Radar Classification for Traffic Intersection Surveillance Based on Micro-Doppler Signatures**  
*Alexis González Argüello, Dominic Berges, Siemens, Germany*
- 190      **Deep Learning-Based Segmentation for the Extraction of Micro-Doppler Signatures**  
*Javier Martinez, Martin Vossiek, FAU Erlangen-Nürnberg, Germany*
- 194      **Deep Learning for Range-Doppler Map Single Frame Classifications of Cooking Processes**  
*Marco Altmann<sup>1</sup>, Peter Ott<sup>1</sup>, Christian Waldschmidt<sup>2</sup>*  
*<sup>1</sup>Hochschule Heilbronn, Germany; <sup>2</sup>Universität Ulm, Germany*
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*Jihoon Kwon, Seungeui Lee, Nojun Kwak, Seoul National University, Korea*

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Chair: Mayazzurra Ruggiano, Thales, The Netherlands

Co-Chair: Stephen Harman, QinetiQ, UK

Time 08:30-10:10, 28 Sept 2018, N109 + N110

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- N/A      **Multi-Temporal Space-Borne SAR Data Exploitation for Surface Monitoring Applications** (Industrial Session Keynote)  
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- 206      **Ground Based Synthetic Aperture Radar with 3D Imaging Capability**  
*Massimiliano Pieraccini, Neda Rojhani, Lapo Miccinesi, Università di Firenze, Italy*
- N/A      **Radar Detection Algorithms for Oil Spill Applications**  
*Bilal Hammoud<sup>1</sup>, Hussam Ayad<sup>1</sup>, Fabien Ndagijimana<sup>2</sup>, Ghaleb Faour<sup>3</sup>, Jalal Jomaah<sup>1</sup>*  
*<sup>1</sup>Lebanese University, Lebanon; <sup>2</sup>Université Grenoble Alpes, France; <sup>3</sup>CNRS-L RSC, Lebanon*
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*Shunichi Futatsumori<sup>1</sup>, Capucine Amielh<sup>2</sup>, Norihiko Miyazaki<sup>1</sup>, Keiji Kobayashi<sup>3</sup>, Nobuo Katsura<sup>4</sup>*  
*<sup>1</sup>ENRI, Japan; <sup>2</sup>ENAC, France; <sup>3</sup>JAXA, Japan; <sup>4</sup>Hokkaido Broadcasting, Japan*

## EuRAD14: EuRAD Interactive Session

Chair: Manuel Rosa-Zurera, Universidad de Alcalá, Spain

Co-Chair: María Pilar Jarabo-Amores, Universidad de Alcalá, Spain

Time 10:10-12:30, 28 Sept 2018, Corridor

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- 230 **Deep Learning Based Human Activity Classification in Radar Micro-Doppler Image**  
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<sup>1</sup>BUPT, China; <sup>2</sup>Tianjin University, China
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- 237 **Enhanced Hidden Object Detection with a Circularly Polarized W-Band Imaging Radar System**  
*Riana H. Geschke*<sup>1</sup>, *Oliver Arpe*<sup>2</sup>, *Ralf Brauns*<sup>2</sup>, *Christian Krebs*<sup>2</sup>  
<sup>1</sup>University of Cape Town, South Africa; <sup>2</sup>Fraunhofer FHR, Germany
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<sup>1</sup>Oriental Institute of Technology, Taiwan; <sup>2</sup>Air Force Institute of Technology, Taiwan

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<sup>1</sup>Hochschule Ulm, Germany; <sup>2</sup>Universität Ulm, Germany; <sup>3</sup>Endress+Hauser, Germany
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<sup>1</sup>Universiti Sains Malaysia, Malaysia; <sup>2</sup>University of Baghdad, Iraq; <sup>3</sup>University of Manchester, UK
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<sup>1</sup>Università di Firenze, Italy; <sup>2</sup>CNIT, Italy
- N/A **High Resolution Terahertz 3-D Image Reconstruction**  
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<sup>1</sup>Chinese Academy of Sciences, China; <sup>2</sup>Katholieke Universiteit Leuven, Belgium
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<sup>1</sup>Chiba Institute of Technology, Japan; <sup>2</sup>AIS Engineering, Japan

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<sup>1</sup>IES (UMR 5214), France; <sup>2</sup>Thales Communications & Security, France
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*Gyuejeong Lee<sup>1</sup>, Seungeui Lee<sup>1</sup>, Kwansung Kim<sup>2</sup>, Nojun Kwak<sup>1</sup>*  
<sup>1</sup>Seoul National University, Korea; <sup>2</sup>ADD, Korea
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- 285 **Improvement of the Angle Measurement Accuracy for Indoor UWB Localization**  
*Nour Awarkeh<sup>1</sup>, Jean-Christophe Cousin<sup>1</sup>, Muriel Muller<sup>2</sup>, Nel Samama<sup>2</sup>*  
<sup>1</sup>LTCI (UMR 5141), France; <sup>2</sup>SAMOVAR (UMR 5157), France

## EuRAD15: FMCW and Continuous Wave Radar

Chair: Nils Pohl, Ruhr-Universität Bochum, Germany

Co-Chair: Reinhard Feger, Johannes Kepler Universität Linz, Austria

Time 10:50–12:30, 28 Sept 2018, N101 + N102

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- 289 **BPSK-Based MIMO FMCW Automotive-Radar Concept for 3D Position Measurement**  
*Yoke Leen Sit, Gang Li, Sarath Manchala, Hamid Afrasiabi, Christian Sturm, Urs Lübbert,*  
*Valeo Schalter und Sensoren, Germany*
- 293 **Mixed-Signal Transmitter Leakage Cancellation for FMCW MIMO Radar**  
*Marc Bauduin, André Bourdoux, imec, Belgium*
- 297 **IQ Imbalance Robust OFDM Radar Waveform**  
*André Bourdoux, Marc Bauduin, Claude Desset, imec, Belgium*
- 301 **Non-Linear Effect Mitigation for FMCW Radar System**  
*Nizar Bouhlel<sup>1</sup>, Stéphane Méric<sup>1</sup>, Claude Moullec<sup>2</sup>, Christian Brousseau<sup>1</sup>*  
<sup>1</sup>IETR (UMR 6164), France; <sup>2</sup>ADVANTEN, France
- 305 **A Highly Integrated Dual Band FMCW Radar Receiver for Indoor Positioning Applications**  
*Mohammed El-Shennawy, Belal Al-Qudsi, Naglaa El Agroudy, Niko Joram, Frank Ellinger,*  
*Technische Universität Dresden, Germany*

## EuRAD16: Drones Detection by Radar

Chair: Pierfrancesco Lombardo, Università di Roma "La Sapienza", Italy

Co-Chair: Felix Yanovsky, National Aviation University, Ukraine

Time 10:50-12:30, 28 Sept 2018, N109 + N110

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- 309      **Numerical and Experimental Evaluation of the Radar Cross Section of a Drone**  
*S. Pisa<sup>1</sup>, E. Piuze<sup>1</sup>, E. Pittella<sup>1</sup>, Pierfrancesco Lombardo<sup>1</sup>, A. Genovese<sup>2</sup>, D. Bloisi<sup>1</sup>,  
D. Nardi<sup>1</sup>, P. d'Atanasio<sup>3</sup>, A. Zambotti<sup>3</sup>*  
<sup>1</sup>Università di Roma "La Sapienza", Italy; <sup>2</sup>Telespazio, Italy; <sup>3</sup>ENEA, Italy
- 313      **Drone Detection Feasibility with Passive Radars**  
*M. Pilar Jarabo-Amores, David Mata-Moya, Pedro J. Gómez-del-Hoyo,  
J.L. Bárcena-Humanes, J. Rosado-Sanz, N. Rey-Maestre, M. Rosa-Zurera, Universidad de  
Alcalá, Spain*
- 317      **Remotely Piloted Aircraft Detection with Persistent Radar**  
*Álvaro Duque de Quevedo, Fernando Ibañez Urzaiz, Javier Gismero Menoyo,  
Alberto Asensio López, Universidad Politécnica de Madrid, Spain*
- 321      **Circular Micro-SAR for Mini-UAV**  
*Matern Otten, Noud Maas, Roland Bolt, Miguel Caro-Cuenca, Henk Medenblik, TNO, The  
Netherlands*
- 325      **Comparisons Between Simulated and Measured X-Band Signatures of Quad-, Hexa-  
and Octocopters**  
*Peter J. Speirs<sup>1</sup>, Arne Schröder<sup>1</sup>, Matthias Renker<sup>2</sup>, Peter Wellig<sup>2</sup>, Axel Murk<sup>1</sup>*  
<sup>1</sup>Universität Bern, Switzerland; <sup>2</sup>armasuisse, Switzerland

## EuMC/EuRAD01: THz Electronics

Chair: Jan Stake, Chalmers University of Technology, Sweden

Co-Chair: William Deal, Northrop Grumman, USA

Time 10:50-12:30, 26 Sept 2018, N110

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- 329      **A W-Band Spatial Power-Combining Amplifier Using GaN MMICs**  
*Lorene A. Samoska, Mark Taylor, Jose Velazco, Andy Fung, Robert Lin, Alejandro Peralta,  
Rohit Gawande, Jet Propulsion Laboratory, USA*
- 333      **A Compact Room-Temperature 510-560GHz Frequency Tripler with 30-mW Output  
Power**  
*Jose V. Siles, Ken B. Cooper, Choonsup Lee, Robert Lin, Goutam Chattopadhyay,  
Imran Mehdi, Jet Propulsion Laboratory, USA*
- 337      **High Power High Efficiency 270-320GHz Source Based on Discrete Schottky Diodes**  
*Diego Moro-Melgar, Oleg Cojocari, Ion Oprea, ACST, Germany*
- 341      **An Integrated Coherent Startup 79-GHz Pulse Oscillator for a Sequential Sampling  
Pulse Radar**  
*A. Leibetseder<sup>1</sup>, C. Wagner<sup>1</sup>, Andreas Stelzer<sup>2</sup>*  
<sup>1</sup>DICE, Austria; <sup>2</sup>Johannes Kepler Universität Linz, Austria
- 345      **High-Spurious-Harmonic-Rejection 32-53GHz and 50-106GHz Frequency Doublers  
Using Digital Logic and DC Negative Feedback**  
*Seong-Kyun Kim<sup>1</sup>, Arda Simsek<sup>2</sup>, Miguel Urteaga<sup>1</sup>, Mark J.W. Rodwell<sup>2</sup>*  
<sup>1</sup>Teledyne Scientific & Imaging, USA; <sup>2</sup>University of California at Santa Barbara, USA

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## EuMC/EuRAD02 : Radar Antennas

Chair: Carlos Montesano, Airbus DS Space, Spain

Co-Chair: Santiago Sobrino Arias, Thales Alenia Space, Spain

Time 13:50-15:30, 26 Sept 2018, N108

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- 349      **A Compact Simultaneous K/S-Band Monopulse Tracking Feed for Future Earth Observation Applications**  
*César Barquinero<sup>1</sup>, Julián I. Gómez<sup>1</sup>, A. Mediavilla<sup>2</sup>, José Luis Besada<sup>3</sup>, Belén Galocha-Iragüen<sup>3</sup>*  
*<sup>1</sup>Indra Sistemas, Spain; <sup>2</sup>Universidad de Cantabria, Spain; <sup>3</sup>Universidad Politécnica de Madrid, Spain*
- 353      **Near-Field Beam Focusing and Steering Generator Based on 3D Curved Substrate Integrated Waveguide**  
*Ya Fei Wu, Yu Jian Cheng, UESTC, China*
- 357      **Enhancing Angle Estimation for Off-Boresight Targets Using Biomimetic Antenna Arrays**  
*Patrik Grüner, Son Nguyen, Tobias Chaloun, Christian Waldschmidt, Universität Ulm, Germany*
- 361      **On the Use of Dielectric Honeycomb as Microwave Substrate for 3D Long Range Radar Antennas**  
*G. Posada, Julián I. Gómez, C. Zarzuelo, Indra Sistemas, Spain*
- 365      **An On-Board Differential Patch Array for 79GHz Single-Channel Radar Applications**  
*Wael A. Ahmad, Dietmar Kissinger, Herman Jalli Ng, IHP, Germany*

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## EuMC/EuRAD03 : THz Communications

Chair: Marion K. Matters-Kammerer, Technische Universiteit Eindhoven, The Netherlands

Co-Chair: Manuel Sierra Castañer, Universidad Politécnica de Madrid, Spain

Time 13:50-15:30, 26 Sept 2018, N110

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- 369      **Towards 100Gbps: A Fully Electronic 90Gbps One Meter Wireless Link at 230GHz**  
*Pedro Rodríguez-Vázquez<sup>1</sup>, J. Grzyb<sup>1</sup>, Neelanjan Sarmah<sup>1</sup>, Bernd Heinemann<sup>2</sup>, Ullrich R. Pfeiffer<sup>1</sup>*  
*<sup>1</sup>Bergische Universität Wuppertal, Germany; <sup>2</sup>IHP, Germany*
- 373      **An Analog-Only Small Cell Unit with Millimeter-Wave Wireless Backhaul for Mobile Communication**  
*Simone Maier<sup>1</sup>, Heinz Schlesinger<sup>1</sup>, Günter Kaltbeitzel<sup>1</sup>, Stefan Merk<sup>1</sup>, Stefan Woerner<sup>1</sup>, Thierry E. Klein<sup>2</sup>, Wolfgang Templ<sup>1</sup>*  
*<sup>1</sup>Nokia Bell Labs, Germany; <sup>2</sup>Nokia Bell Labs, USA*
- 377      **Performance Evaluation of a 220-260GHz LO Tunable BPSK/QPSK Wireless Link in SiGe HBT Technology**  
*J. Grzyb<sup>1</sup>, P. Rodriguez Vazquez<sup>1</sup>, Neelanjan Sarmah<sup>1</sup>, Bernd Heinemann<sup>2</sup>, Ullrich R. Pfeiffer<sup>1</sup>*  
*<sup>1</sup>Bergische Universität Wuppertal, Germany; <sup>2</sup>IHP, Germany*
- 381      **Analog Carrier Recovery for Broadband Wireless Communication Links**  
*Parisa Harati<sup>1</sup>, Aleks Dyskin<sup>2</sup>, Ingmar Kallfass<sup>1</sup>*  
*<sup>1</sup>Universität Stuttgart, Germany; <sup>2</sup>Technion, Israel*
- 385      **15Gbps Wireless Link Using W-Band Resonant Tunnelling Diode Transmitter**  
*Jue Wang<sup>1</sup>, Abdullah Al-Khalidi<sup>1</sup>, Razvan Morariu<sup>1</sup>, Afesomah Ofiare<sup>1</sup>, Liquan Wang<sup>2</sup>, Edward Wasige<sup>1</sup>*  
*<sup>1</sup>University of Glasgow, UK; <sup>2</sup>SAST, China*

## EuMC/EuRAD04: Emerging Antenna Fabrication Technologies

Chair: Jean-Yves Dauvignac, Université Côte d'Azur, France

Co-Chair: Ville Viikari, Aalto University, Finland

Time 16:10-17:50, 26 Sept 2018, N108

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- 389      **3D Printed Slotted Waveguide Array Antenna for Automotive Radar Applications in W-Band**  
*K. Lomakin<sup>1</sup>, D. Simon<sup>2</sup>, M. Sippel<sup>1</sup>, K. Helmreich<sup>1</sup>, E. Seler<sup>2</sup>, Z. Tong<sup>2</sup>, R. Reuter<sup>2</sup>, G. Gold<sup>1</sup>*  
<sup>1</sup>FAU Erlangen-Nürnberg, Germany; <sup>2</sup>NXP Semiconductors, Germany
- 393      **A 24-GHz Radar with 3D-Printed and Metallized Lightweight Antennas for UAV Applications**  
*Thomas Lampersberger<sup>1</sup>, Reinhard Feger<sup>1</sup>, Andreas Haderer<sup>2</sup>, Christian Egger<sup>1</sup>, Martin Friedl<sup>1</sup>, Andreas Stelzer<sup>1</sup>*  
<sup>1</sup>Johannes Kepler Universität Linz, Austria; <sup>2</sup>INRAS, Austria
- 397      **Additive Manufactured Antenna in Mixed Material Technology for 24GHz FMCW Miniaturized Radar**  
*Cristina Yepes<sup>1</sup>, Erio Gandini<sup>1</sup>, Raymond van Dijk<sup>1</sup>, Fabien Bruning<sup>2</sup>, Hessel Maalderink<sup>2</sup>, Stefania Monni<sup>1</sup>, Frank E. van Vliet<sup>1</sup>*  
<sup>1</sup>TNO, The Netherlands; <sup>2</sup>AMSYSTEMS Center, The Netherlands
- 401      **A New Waveguide Slot Array Antenna with High Isolation and High Antenna Bandwidth Operation on Ku- and K- Bands for Radar and MIMO Systems**  
*Mohammad Alibakhshikenari<sup>1</sup>, Bal Singh Virdee<sup>2</sup>, Chan H. See<sup>3</sup>, Raed Abd-Alhameed<sup>4</sup>, Francisco Falcone<sup>5</sup>, Ernesto Limiti<sup>1</sup>*  
<sup>1</sup>Università di Roma "Tor Vergata", Italy; <sup>2</sup>London Metropolitan University, UK;  
<sup>3</sup>University of Bolton, UK; <sup>4</sup>University of Bradford, UK; <sup>5</sup>Universidad Pública de Navarra, Spain

- 405      **Study on Antenna Mutual Coupling Suppression Using Integrated Metasurface Isolator for SAR and MIMO Applications**  
*Mohammad Alibakhshikenari<sup>1</sup>, Bal Singh Virdee<sup>2</sup>, Chan H. See<sup>3</sup>, Raed Abd-Alhameed<sup>4</sup>, Francisco Falcone<sup>5</sup>, Aurora Andújar<sup>6</sup>, Jaime Anguera<sup>6</sup>, Ernesto Limiti<sup>1</sup>*  
<sup>1</sup>Università di Roma "Tor Vergata", Italy; <sup>2</sup>London Metropolitan University, UK;  
<sup>3</sup>University of Bolton, UK; <sup>4</sup>University of Bradford, UK; <sup>5</sup>Universidad Pública de Navarra, Spain; <sup>6</sup>Fractus Antennas, Spain

## EuMC/EuRAD05: THz Radar

Chair: María Pilar Jarabo-Amores, Universidad de Alcalá, Spain

Co-Chair: Nils Pohl, Ruhr-Universität Bochum, Germany

Time 16:10-17:50, 26 Sept 2018, N110

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- 409      **Long Range-Doppler Demonstration of a 95GHz FMCW Radar**  
*Raquel R. Monje, Ken B. Cooper, Robert J. Dengler, Corey J. Cochrane, Stephen L. Durden, Adrian Tang, Mathieu Choukroun, Jet Propulsion Laboratory, USA*
- 413      **Size Determination in Particle Streams Using a Multistatic Dual Frequency Millimeter Wave Radar**  
*Alwin Reinhardt, Alexander Teplyuk, Reinhard Knöchel, Michael Höft, Christian-Albrechts-Universität zu Kiel, Germany*
- 417      **Differential Absorption Radar at 170GHz for Atmospheric Boundary Layer Water Vapor Profiling**  
*Richard J. Roy, Ken B. Cooper, Matthew Lebsock, Luis Millán, Jose V. Siles, Raquel R. Monje, Jet Propulsion Laboratory, USA*
- 421      **CM-CFAR Parameter Learning Based Square-Law Detector for Foreign Object Debris Radar**  
*Kudret Akçapınar, Süleyman Baykut, TÜBİTAK BİLGEM, Turkey*
- 425      **Signal Reduction by Tree Leaves in Low-THz Automotive Radar**  
*Shahzad Sabery, Fatemeh Norouzian, Peter Gardner, Edward Hoare, Mikhail Cherniakov, Marina Gashinova, University of Birmingham, UK*

## EuMC/EuRAD06: Array Technology and Characterization

Chair: Claire Migliaccio, Université Côte d'Azur, France

Co-Chair: Arne F. Jacob, Technische Universität Hamburg-Harburg, Germany

Time 10:50-12:30, 27 Sept 2018, N117

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- N/A      **Spaceborne Radiometers and Active Antennas for Space Applications (Industrial Session Keynote)**  
*Antonio Montesano, Airbus Defence & Space, Spain*
- 429      **Differential Multi-Layer Compact Grid Antenna Array for 79GHz Automotive Radar Applications**  
*M. Mosalanejad<sup>1</sup>, I. Ocket<sup>1</sup>, C. Soens<sup>2</sup>, Guy A.E. Vandenbosch<sup>1</sup>*  
*<sup>1</sup>imec, Belgium; <sup>2</sup>Katholieke Universiteit Leuven, Belgium*
- 433      **A Full-Array-Grid-Compatible Wideband Tx/Rx Multipack Using Multifunctional Chips on GaN and SiGe**  
*Ralf Rieger, Andreas Klaaßen, Patrick Schuh, Martin Oppermann, HENSOLDT Sensors, Germany*
- 437      **Diagnostics of the Phased Array for E-Band Using Holography Data**  
*Mikko K. Leino, Md. Mazidul Islam, Juha Ala-Laurinaho, Ville Viikari, Aalto University, Finland*
- 441      **A Zero-IF Auto-Calibration System for Phased Array Antennas**  
*Mehdi Salehi, Safieddin Safavi-Naeini, University of Waterloo, Canada*

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## EuMC/EuRAD07: EuMC/EuRAD Interactive Session

Chair: Manuel Sierra Castañer, Universidad Politécnica de Madrid, Spain

Co-Chair: Daniel Segovia-Vargas, Universidad Carlos III de Madrid, Spain

Time 12:30–13:50, 27 Sept 2018, Exhibition Hall

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- 445 **Implementing Wideband Monopole/Dipole Antennas on Paper Substrates**  
*Ch. Person<sup>1</sup>, Duc Nguyen<sup>1</sup>, J.Ph. Coupez<sup>1</sup>, Ph. Minard<sup>2</sup>, D. Lo Hine Tong<sup>2</sup>, P. Borel<sup>3</sup>, D. Izoard<sup>3</sup>*  
<sup>1</sup>Lab-STICC (UMR 6285), France; <sup>2</sup>Technicolor, France; <sup>3</sup>CTP, France
- 449 **Frequency Doubler Based Outphasing System for Millimeter Wave Vector Signal Generation**  
*Arthur Chung<sup>1</sup>, Marwen Ben Rejeb<sup>1</sup>, Ali Darwish<sup>2</sup>, H. Alfred Hung<sup>2</sup>, Slim Boumaiza<sup>1</sup>*  
<sup>1</sup>University of Waterloo, Canada; <sup>2</sup>U.S. Army Research Laboratory, USA
- 453 **A 2D Method for Acquiring the Radiation Pattern of Two-Identical Vivaldi Antennas by Using a Stepped-Frequency Continue Wave (SFCW) Radar and a Rotation Stage**  
*J.L. Solano, V. Ortega, R.S. Silla, W. Schröder, L. Schüssele, Hochschule Offenburg, Germany*
- 457 **Dipole Antenna Printed on Paper Substrate for WLAN Applications**  
*D. Lo Hine Tong<sup>1</sup>, Ph. Minard<sup>1</sup>, Ch. Person<sup>2</sup>, J.Ph. Coupez<sup>2</sup>, P. Borel<sup>3</sup>, D. Izoard<sup>3</sup>*  
<sup>1</sup>Technicolor, France; <sup>2</sup>Lab-STICC (UMR 6285), France; <sup>3</sup>CTP, France
- 461 **EBG Enhanced Broadband Dual Antenna Configuration for Passive Self-Interference Suppression in Full-Duplex Communications**  
*Prafulla Deo<sup>1</sup>, Dariush Mirshekar-Syahkal<sup>1</sup>, Gan Zheng<sup>2</sup>*  
<sup>1</sup>University of Essex, UK; <sup>2</sup>Loughborough University, UK
- 465 **A Real-Time Non-Destructive Water Status Monitoring System at Terahertz Band**  
*C. Quemada, J.C. Iriarte, D. Marín, C. Miranda, R. Gonzalo, L.G. Santesteban, I. Ederra, Universidad Pública de Navarra, Spain*

- 469 **W-Band Millimeter-Wave On-Chip Log-Periodic Dipole Antenna with Integrated Balun Filter in GIPD Process**  
*H.-C. Wang, C.-C. Chou, H.-R. Chuang, National Cheng Kung University, Taiwan*
- 473 **Design of a Dual-Band Feed System for S/X-Band VLBI Observations**  
*Moon-Hee Chung, KASI, Korea*
- 477 **Low-Loss Loaded Line Phase Shifter for Radar Application in X Band**  
*Xiaoliang Sun, José-Manuel Fernández-González, Manuel Sierra-Pérez, Belén Galocha-Iragüen, Universidad Politécnica de Madrid, Spain*
- 481 **Mode Conversion Processes in Multilayer Spherical Resonators**  
*Ingo Wolff, IMST, Germany*
- 485 **A Stand Alone Millimetre Wave Imaging Scanner: System Design and Image Analysis Setup**  
*Andries Küter, Christopher Schwäbig, Christian Krebs, Ralf Brauns, Stefan Kose, Dirk Nüßler, Fraunhofer FHR, Germany*
- 489 **Dispersion of THz Modes Localized on Layered Superconductor Controlled by DC Magnetic Field**  
*T. Rokhmanova<sup>1</sup>, S.S. Apostolov<sup>1</sup>, N. Kvitka<sup>2</sup>, V.A. Yampol'skii<sup>1</sup>*  
<sup>1</sup>NASU, Ukraine; <sup>2</sup>V.N. Karazin Kharkiv National University, Ukraine
- 493 **E-Band Impulse Radio Transceiver with 2-Bit Pulse-Position Modulation**  
*Hiroshi Matsumura, Ikuo Soga, Shoichi Shiba, Kazuaki Oishi, Yoichi Kawano, Yasuhiro Nakasha, Toshihide Suzuki, Fujitsu Laboratories, Japan*

|     |                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 497 | <b>A DC to 40GHz, High Linearity Monolithic GaAs Distributed Amplifier with Low DC Power Consumption as a High Bit-Rate Pre-Driver</b><br><i>Laura Diego<sup>1</sup>, Benoît Haentjens<sup>1</sup>, Charles A. Mjema<sup>1</sup>, Iban Barrutia<sup>2</sup>, Amparo Herrera<sup>2</sup>, Yan Haentjens<sup>1</sup></i><br><sup>1</sup> Vectrawave, France; <sup>2</sup> Universidad de Cantabria, Spain |
| 501 | <b>Design of Broadband Gap Waveguide Transitions for Millimeter-Wave Antenna Arrays</b><br><i>Miguel Ferrando-Rocher, Daniel Sánchez-Escuderos, Jose I. Herranz-Herruzo, Alejandro Valero-Nogueira, Universitat Politècnica de València, Spain</i>                                                                                                                                                      |
| 505 | <b>A Circularly Polarized Circular Antenna Array for Satellite TV Reception</b><br><i>Ahmed Alieldin, Yi Huang, Manoj Stanley, Sumin Joseph, University of Liverpool, UK</i>                                                                                                                                                                                                                            |
| 509 | <b>Design and Demonstration of Linearly-Polarized Transmit-Arrays in X-Band</b><br><i>Hamza Kaouach<sup>1</sup>, Mohamed Ali Belaid<sup>2</sup></i><br><sup>1</sup> LAPLACE (UMR 5213), France; <sup>2</sup> University of Sousse, Tunisia                                                                                                                                                              |
| 513 | <b>Distributed Signal Processing of High-Resolution FMCW MIMO Radar for Automotive Applications</b><br><i>Farhan B. Khalid, Dian Tresna Nugraha, André Roger, Romain Ygnace, Markus Bichl, Infineon Technologies, Germany</i>                                                                                                                                                                           |
| 517 | <b>Real-Time Synthetic Aperture Radar for Automotive Embedded Systems</b><br><i>Florian Fembacher, Farhan B. Khalid, Gabor Balazs, Dian Tresna Nugraha, André Roger, Infineon Technologies, Germany</i>                                                                                                                                                                                                 |
| 521 | <b>Dual-Channel Single Sideband Transmitter in 45nm CMOS SOI for a 70GHz OFDM Radar</b><br><i>Daniel Schindler<sup>1</sup>, Michael Thiel<sup>1</sup>, Mohamed Elkhoully<sup>1</sup>, Yikun Yu<sup>1</sup>, Benedikt Schweizer<sup>2</sup>, Jürgen Hasch<sup>1</sup>, Christian Waldschmidt<sup>2</sup></i><br><sup>1</sup> Robert Bosch, Germany; <sup>2</sup> Universität Ulm, Germany                |

## EuMC/EuRAD08: Innovative Signal Processing in Array Technology

Chair: Ioan Lager, Technische Universiteit Delft, The Netherlands

Co-Chair: Wnuk Marian, Military University of Technology, Switzerland

Time 13:50-15:30, 27 Sept 2018, N108

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| 525 | <b>Efficient Shaped-Beam Reflectarray Design Using Machine Learning Techniques</b><br><i>Daniel R. Prado<sup>1</sup>, Jesús A. López-Fernández<sup>2</sup>, Manuel Arrebola<sup>2</sup>, George Goussetis<sup>1</sup></i><br><sup>1</sup> Heriot-Watt University, UK; <sup>2</sup> Universidad de Oviedo, Spain |
| 529 | <b>Interpolation of Missing Antenna Measurements or RCS Data Using the Matrix Pencil Method</b><br><i>Nicolas F. Reginelli<sup>1</sup>, Tapan K. Sarkar<sup>1</sup>, Magdalena Salazar-Palma<sup>2</sup></i><br><sup>1</sup> Syracuse University, USA; <sup>2</sup> Universidad Carlos III de Madrid, Spain     |
| 533 | <b>Quality Analysis of Antenna Reflection Coefficient in Massive MIMO Antenna Array Module</b><br><i>Marko E. Leinonen, Nuutti Tervo, Marko Sonkki, Aarno Pärssinen, University of Oulu, Finland</i>                                                                                                            |
| 537 | <b>Characteristics of Circularly Polarized Multimode Helical Beams</b><br><i>Giulio Richichi, Gary Junkin, Universitat Autònoma de Barcelona, Spain</i>                                                                                                                                                         |
| 541 | <b>Parallel Fed Patch Array for Microwave-Based Vital Sign Monitoring of Elderly People</b><br><i>Sassan Schäfer, Andreas R. Diwald, Daniel Schmiech, Simon Müller, Hochschule Trier, Germany</i>                                                                                                               |

## EuMC/EuRAD09 : Array Beamforming Techniques

Chair: Jozef Modelski, Warsaw University of Technology, Poland

Co-Chair: Patrik Grüner, Universität Ulm, Germany

Time 13:50–15:30, 27 Sept 2018, N117

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- 545      **Accurate PPCC-Based DoA Estimation Using Multiple Calibration Planes for WSN Nodes Equipped with ESPAR Antennas**  
*Mateusz Groth, L. Kulas, Gdansk University of Technology, Poland*
- 549      **A New Super-Resolution Technique for Direction (and Time) of Arrival Detection**  
*Abbas Omar, OvG Universität Magdeburg, Germany*
- 553      **Analog Beamforming Based on Fourier Rotman Lens for Multibeam Applications**  
*Pavel Turalchuk<sup>1</sup>, Irina Munina<sup>1</sup>, Alexey Shitvov<sup>2</sup>*  
*<sup>1</sup>St. Petersburg Electrotechnical University, Russia; <sup>2</sup>Cardiff University, UK*
- 557      **Initial Design of Phase-Frequency Scanned Array Using CRLH Leaky-Wave Antennas**  
*Qingshan Yang<sup>1</sup>, Xiaowen Zhao<sup>1</sup>, Yunhua Zhang<sup>2</sup>*  
*<sup>1</sup>Chinese Academy of Sciences, China; <sup>2</sup>UCAS, China*
- 561      **Experimental Demonstration of a Software-Defined-Radio Adaptive Beamformer**  
*Daniel Gaydos, Payam Nayeri, Randy Haupt, Colorado School of Mines, USA*